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[Claim(s)]

[Claim 1] The impulse-wave power control approach which repeats peak current and base current to pulse form, supplies them between a welding wire and a weld base material, and is characterized by the thing of a welding output electrical potential difference or setting-out welding voltage for which the pulse period of a current is set up using either at least.

[Claim 2] The impulse-wave power control approach according to claim 1 which repeats peak current and base current to pulse form, supplies them between a welding wire and a weld base material, and is characterized by the thing of a welding output electrical potential difference or setting-out welding voltage for which the pulse period of a current is set up using either and setting-out pulse frequency at least.

[Claim 3] The impulse-wave power control approach according to claim 1 or 2 characterized by setting up the upper limit and lower limit of a pulse period of a current according to at least one of the amount of wire feeding, a wire gage, or the wire construction material.

[Claim 4] The welding voltage detecting element which detects welding voltage, and the welding voltage setting-out part which sets up welding voltage, The error amplifier which considers the output of said welding voltage detecting element, and the output of said welding voltage setting-out part as an input, and amplifies the difference of these two inputs, The pulse frequency setting-out part which sets pulse frequency to a pulse period operation, The impulse-wave output setting-out part which outputs the impulse-wave output signal which is equivalent to a welding output from the output of said welding voltage detecting element, the output of said welding voltage setting-out part, the output of said pulse frequency setting-out part, and the output of said error amplifier, The consumable electrode type pulsed-arc-welding apparatus equipped with the peak current setting-out part which sets up peak current, the base current setting-out part which sets up base current, and the switching circuit part which chooses the output of said peak current setting-out part, or the output of said base current

setting-out part with the output of said impulse-wave output setting-out part.
[Claim 5] The amount setting-out part of wire feeding which sets up the amount of wire feeding, and the wire-gage setting-out part which sets up a wire gage, The wire construction material setting-out part which sets up wire construction material, The output of said amount setting-out part of wire feeding, the output of a wire-gage setting-out part, and the output of a wire construction material setting-out part are considered as an input. The consumable electrode type pulsed-arc-welding apparatus [equipped with said impulse-wave output setting-out part having contained the limiter setting-out part which sets up the upper limit and lower limit of a pulse period according to at least one of the amount of wire feeding, a wire gage, or the wire construction material] according to claim 4.
[Claim 6] The impulse-wave power control approach which repeats peak current and base current to pulse form, supplies them between a welding wire and a weld base material, and is characterized by the thing of a welding output electrical potential difference or setting-out welding voltage for which peak current is set up using either and setting-out pulse frequency at least.
[Claim 7] The welding voltage detecting element which detects welding voltage, and the welding voltage setting-out part which sets up welding voltage, The error amplifier which considers the output of said welding voltage detecting element, and the output of said welding voltage setting-out part as an input, and amplifies the difference of these two inputs, The pulse period setting-out part which sets up a pulse period, and the pulse frequency setting-out part which sets pulse frequency to a peak current operation, The impulse-wave output setting-out part which outputs the impulse-wave output signal which considers the output of said error amplifier, and the output of said pulse period setting-out part as an input, and is equivalent to a welding output, The peak current operation part which considers the output of said welding voltage setting-out part, the output of said welding voltage detecting element, the output of said pulse period setting-out part, and the output of said pulse frequency setting-out part as an input, and sets up peak current, The consumable electrode type pulsed-arc-welding apparatus equipped with the base current setting-out part which sets up base current, and the switching circuit part which chooses the output of said peak current operation part, or the output of said base current setting-out part with the output of said impulse-wave output setting-out part.
[Claim 8] The amount setting-out part of wire feeding which sets up the amount of wire feeding, and the wire-gage setting-out part which sets up a wire gage, The wire construction material setting-out part which sets up wire construction material, The consumable electrode type pulsed-arc-welding apparatus [equipped with the pulse period setting-out part which sets up a pulse period according to at least one of the amount of wire feeding, a wire gage, or the wire construction material by considering the output of said amount setting-out part of wire feeding, the output of a wire-gage setting-out part, and the output of a wire construction material

setting-out part as an input] according to claim 7.

[Claim 9] The amount setting-out part of wire feeding which sets up the amount of wire feeding, and the wire-gage setting-out part which sets up a wire gage, The wire construction material setting-out part which sets up wire construction material, The output of said amount setting-out part of wire feeding, the output of said wire-gage setting-out part, and the output of said wire construction material setting-out part are considered as an input. The consumable electrode type pulsed-arc-welding apparatus [equipped with the pulse frequency setting-out part which sets up the pulse frequency for a pulse period operation according to at least one of the amount of wire feeding, a wire gage, or the wire construction material] according to claim 4 or 7.

[Claim 10] Between a welding wire and a weld base material, repeat peak current and base current to pulse form, supply them, and the droplet secession forecast signal which foreknows that a droplet secedes from a wire head using a welding output electrical potential difference is detected. The impulse-wave power control approach characterized by using this droplet secession forecast signal as timing of termination of the pulse period of a current, and setting up the pulse period of a current.

[Claim 11] The comparing element which outputs a droplet secession forecast signal when the comparison operation of the welding voltage detecting element which detects welding voltage, and the output of said welding voltage detecting element and the output of an electrical-potential-difference setting-out part is carried out and the output of said welding voltage detecting element exceeds the output of said electrical-potential-difference setting-out part, The error amplifier which considers the welding voltage setting-out part which sets up welding voltage, and the output of said welding voltage detecting element and the output of said welding voltage setting-out part as an input, and amplifies the difference of these two inputs, The pulse frequency operation part which considers the output of said error amplifier as an input, and sets up pulse frequency, The impulse-wave output setting-out part which outputs the impulse-wave output signal which considers the output of said comparing element, and the output of said pulse frequency operation part as an input, makes the output of said pulse frequency operation part a peak term start signal, and is equivalent to a welding output using the output of said comparing element as a termination signal of a peak term, The consumable electrode type pulsed-arc-welding apparatus equipped with the peak current setting-out part which sets up peak current, the base current setting-out part which sets up base current, and the switching circuit part which chooses the output of said peak current setting-out part, or the output of said base current setting-out part with the output of said pulse period setting-out part.

[Claim 12] The amount setting-out part of wire feeding which sets up the amount of wire feeding, and the wire-gage setting-out part which sets up a wire gage, The wire construction

material setting-out part which sets up wire construction material, The output of said amount setting-out part of wire feeding, the output of a wire-gage setting-out part, and the output of a wire construction material setting-out part are considered as an input. A consumable electrode type pulsed-arc-welding apparatus given in either of the Claims 4, 7 and 11 equipped with the base current setting-out part which sets up base current according to at least one of the amount of wire feeding, a wire gage, or the wire construction material.
[Claim 13] The amount setting-out part of wire feeding which sets up the amount of wire feeding, and the wire-gage setting-out part which sets up a wire gage, The wire construction material setting-out part which sets up wire construction material, The output of said amount setting-out part of wire feeding, the output of a wire-gage setting-out part, and the output of a wire construction material setting-out part are considered as an input. The consumable electrode type pulsed-arc-welding apparatus [equipped with the peak current setting-out part which sets up peak current according to at least one of the amount of wire feeding, a wire gage, or the wire construction material] according to claim 4 or 11.

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention feeds a consumable electrode (a wire is called hereafter) automatically, and relates to the welding output control approach and consumable electrode type pulsed-arc-welding apparatus which repeat peak current and base current by turns, supply them between a wire and a weld base material (a base material is called hereafter), and perform welding output control.
[0002]
[Description of the Prior Art] Conventionally, it was architecture as shown in drawing 10 as an example of the power control approach of a consumable electrode type pulsed-arc-welding machine, and was the power control approach of having fixed a pulse period and changing pulse frequency. fuse a wire point, form a droplet, a droplet is made to break away according to the electromagnetism pinch force of peak current, and this pulse period is made to shift to a base material, whenever peak current is outputted (1 impulse-wave 1 drops are called below) -- it is set as an optimum value like. For this reason, the weld which birth of a short circuit is controlled in the output condition of 1 impulse-wave 1 drops, and a spatter hardly generates as shown in drawing 11 was possible.
[0003] The architecture of the consumable electrode type pulsed-arc-welding apparatus of conventional parallel is explained along with drawing 10 below. in drawing 10 -- 1 -- 3 phase input power and 2 -- the 1st commutation part and 3 -- an inverter circuit part and 4 -- a main

transformer and 5 -- as for an output negative terminal and 22, a reactor and 20 are [a wire and 24] base materials a tip and 23 an output positive terminal and 21 the 2nd commutation part and 6. Error magnification of the output of the welding voltage detecting element 7 and the output of the welding voltage setting-out part 9 is carried out by the error amplifier 8. The pulse frequency signal was outputted by the pulse frequency operation part 18 with the output of this error amplifier 8, and the signal equivalent to the pulse frequency and the pulse period for a welding output of the pulse period setting-out part 13 which sets up this pulse frequency signal and pulse period more suitable than an output in the impulse-wave output setting-out part 10c had been acquired.

[0004]

[Problem to be solved by the invention] As mentioned above, the spatter was able to be controlled by setting up the optimal pulse period for 1 impulse-wave 1 drops. However, in recent years, in order to raise productivity, the inclination which raises welding speed has become strong. When it is necessary to reduce welding voltage to raise welding speed and welding voltage is reduced, as shown in drawing 12 , in order not to change a pulse period by the conventional control approach, the average of pulse frequency falls. however, since the amount of wire feeding is constant, the optimal pulse period for 1 impulse-wave 1 drops is set up -- **** -- since it is alike, and it is not concerned but the pulse frequency to the amount of wire feeding runs short, before a droplet breaks away, a short circuit occurs. Moreover, since the magnitude of the droplet which remains at the head of a wire is uneven, the birth frequency of a short circuit becomes irregular. For this reason, the yield of a spatter increases and it becomes the factor which adheres to a base material, a discharge jet, etc. and bars improvement in productivity.

[0005] A pulse period is shortened so that the average of pulse frequency may not be changed, when this invention compensates the defect of said conventional technique and it reduces welding voltage. It aims at offering the impulse-wave power control approach and consumable electrode type pulsed-arc-welding apparatus which are made to generate a short circuit regularly for every impulse wave, and control the yield of a spatter.

[0006] Moreover, this invention reduces peak current so that the average of pulse frequency may not be changed, when reducing welding voltage, and it aims at offering the impulse-wave power control approach and consumable electrode type pulsed-arc-welding apparatus which are made to generate a short circuit regularly for every impulse wave, and control the yield of a spatter.

[0007] Moreover, this invention detects the welding voltage which changes just before a droplet secedes from a wire head, foreknows secession of a droplet, and ends a pulse period. It aims at offering the impulse-wave power control approach and consumable electrode type pulsed-arc-welding apparatus which make regular droplet transfer for every impulse wave, and

control the yield of a spatter by this.

[0008]

[Means for solving problem] In order to attain the above-mentioned technical problem, the impulse-wave power control approach of the 1st invention is a thing of a welding output electrical potential difference or setting-out welding voltage which sets up a pulse period using either at least. Moreover, when setting up a pulse period, it is the thing of a welding output electrical potential difference or setting-out welding voltage which sets up a pulse period using either and setting-out pulse frequency at least. Moreover, according to at least one of the amount of wire feeding, a wire gage, or the wire construction material, the upper limit and lower limit of a pulse period are set up this pulse period. Next, the consumable electrode type pulsed-arc-welding apparatus using the impulse-wave power control approach of the 1st invention is explained. The welding voltage detecting element which detects welding voltage, and the welding voltage setting-out part which sets up welding voltage, The error amplifier which considers the output of said welding voltage detecting element, and the output of said welding voltage setting-out part as an input, and amplifies the difference of these two inputs, The pulse frequency setting-out part which sets pulse frequency to a pulse period operation, The impulse-wave output setting-out part which outputs the impulse-wave output signal of the output of said welding voltage detecting element, and the output of said welding voltage setting-out part which is equivalent to a welding output using either, the output of said pulse frequency setting-out part, and the output of said error amplifier at least, It has the peak current setting-out part which sets up peak current, the base current setting-out part which sets up base current, and the switching circuit part which chooses the output of said peak current setting-out part, or the output of said base current setting-out part with the output of said impulse-wave output setting-out part.

[0009] The impulse-wave power control approach of the 2nd invention is a thing of a welding output electrical potential difference or setting-out welding voltage which sets up peak current using either and setting-out pulse frequency at least. [the consumable electrode type pulsed-arc-welding apparatus of the 2nd invention] The welding voltage detecting element which detects welding voltage, and the welding voltage setting-out part which sets up welding voltage, The error amplifier which considers the output of said welding voltage detecting element, and the output of said welding voltage setting-out part as an input, and amplifies the difference of these two inputs, The pulse frequency setting-out part which sets pulse frequency to a peak current operation, The pulse period setting-out part which sets up a pulse period, and the peak current operation part of the output of said welding voltage setting-out part, or the output of said welding voltage detecting element which considers one of outputs, the output of said pulse period setting-out part, and the output of said pulse frequency setting-out part as an input at least, and sets up peak current, It has the base current setting-out part which sets up

base current, and the switching circuit part which chooses the output of said peak current operation part, or the output of said base current setting-out part with the output of said impulse-wave output setting-out part.

[0010] The impulse-wave power control approach of the 3rd invention detects the droplet secession forecast signal which foreknows that a droplet secedes from a wire head using a welding output electrical potential difference, and this droplet secession forecast signal is used for it as timing of termination of a pulse period, and it sets up a pulse period. [the consumable electrode type pulsed-arc-welding apparatus of the 3rd invention] The comparing element which outputs a droplet secession forecast signal when the comparison operation of the welding voltage detecting element which detects welding voltage, and the output of said welding voltage detecting element and the output of an electrical-potential-difference setting-out part is carried out and the output of said welding voltage detecting element exceeds the output of said electrical-potential-difference setting-out part, The error amplifier which considers the welding voltage setting-out part which sets up welding voltage, and the output of said welding voltage detecting element and the output of said welding voltage setting-out part as an input, and amplifies the difference of these two inputs, The pulse frequency operation part which considers the output of said error amplifier as an input, and sets up pulse frequency, The impulse-wave output setting-out part which outputs the impulse-wave output signal which considers the output of said comparing element, and the output of said pulse frequency operation part as an input, makes the output of said pulse frequency operation part a peak term start signal, and is equivalent to a welding output using the output of said comparing element as a termination signal of a peak term, It has the peak current setting-out part which sets up peak current, the base current setting-out part which sets up base current, and the switching circuit part which chooses the output of said peak current setting-out part, or the output of said base current setting-out part with the output of said pulse period setting-out part.

[0011] Moreover, the peak current setting-out part of said 1st [the] and the consumable electrode type pulsed-arc-welding apparatus of the 3rd invention is set up according to at least one setting out of the amount of wire feeding, wire construction material, or a wire gage.

[0012]

[Mode for carrying out the invention] The impulse-wave power control approach of the 1st invention and a consumable electrode type pulsed-arc-welding apparatus are things of a welding output electrical potential difference or setting-out welding voltage which set up a pulse period using either at least. When setting up a pulse period, it has the operation of a welding output electrical potential difference or setting-out welding voltage which sets up a pulse period using either and setting-out pulse frequency at least. Moreover, a pulse period has the operation to which the upper limit and lower limit of a pulse period are set according to

at least one of the amount of wire feeding, a wire gage, or the wire construction material. namely, [these impulse-wave power control approaches and a consumable electrode type pulsed-arc-welding apparatus] By setting up a pulse period not changing the average of pulse frequency when reducing welding voltage, the short circuit generated at the time of welding voltage lowering is regularly generated for every impulse wave, and the yield of a spatter is controlled. Moreover, when setting up a pulse period, the limiter setting-out part which sets up the upper limit and lower limit of a pulse period according to at least one of the amount of wire feeding, a wire gage, or the wire construction material is prepared in said impulse-wave output setting-out circles, and weld is stabilized. Moreover, the pulse frequency setting-out part which sets up the pulse frequency for a pulse period operation can be set up according to at least one of the amount of wire feeding, a wire gage, or the wire construction material, and the response range expands it.

[0013] The impulse-wave power control approach of the 2nd invention and a consumable electrode type pulsed-arc-welding apparatus have the operation of a welding output electrical potential difference or setting-out welding voltage which sets up peak current using either and setting-out pulse frequency at least. That is, by reducing peak current so that the average of pulse frequency may not be changed, when reducing welding voltage, a short circuit is regularly generated for every impulse wave, and the yield of a spatter can be controlled. Moreover, the pulse period setting-out part which sets up a pulse period can be set up according to at least one of the amount of wire feeding, a wire gage, or the wire construction material. Moreover, the pulse frequency setting-out part which sets up the pulse frequency of the 1st and the consumable electrode type pulsed-arc-welding apparatus of the 2nd invention can be set up according to at least one of the amount of wire feeding, a wire gage, or the wire construction material, and the response range expands it.

[0014] [next, the impulse-wave power control approach of the 3rd invention and a consumable electrode type pulsed-arc-welding apparatus] The droplet secession forecast signal which foreknows that a droplet secedes from a wire head using a welding output electrical potential difference is detected, and it has the operation which uses this droplet secession forecast signal as timing of termination of a pulse period, and sets up a pulse period. That is, by foreknowing secession of the droplet from a wire head and ending a pulse period, droplet transfer for every impulse wave is made regular, and the yield of a spatter can be controlled.

[0015] Moreover, the base current setting-out part of said 1st the 2 and the consumable electrode type pulsed-arc-welding apparatus of the 3rd invention is set up according to at least one setting out of the amount of wire feeding, wire construction material, or a wire gage. For this reason, it can set up for every amount of wire feeding, wire construction material, and wire gage, and the response range is expanded.

[0016] Moreover, the peak current setting-out part of said 1st [the] and the consumable

electrode type pulsed-arc-welding apparatus of the 3rd invention is set up according to at least one setting out of the amount of wire feeding, wire construction material, or a wire gage. For this reason, it can set up for every amount of wire feeding, wire construction material, and wire gage, and the response range is expanded.

[0017] (Form 1 of operation) The consumable electrode type pulsed-arc-welding apparatus which enforced the impulse-wave power control approach of the 1st invention is explained along with drawing 1 and drawing 7 . In addition, the same part as the conventional architecture attaches the same code, and omits the description.

[0018] [namely, the consumable electrode type pulsed-arc-welding apparatus of the form of the 1st operation] The welding voltage detecting element 7 which detects welding voltage, and the welding voltage setting-out part 9 which sets up welding voltage, The error amplifier 8 which considers the output of said welding voltage detecting element 7, and the output of said welding voltage setting-out part 9 as an input, and amplifies the difference of these two inputs, To a pulse period operation, [output / the average welding voltage VOUT of the output of said welding voltage detecting element 7, or the output of said welding voltage setting-out part 9 obtained using either at least, and / of said welding voltage detecting element 7 / the welding voltage VP in a peak term, and the welding voltage VB in a base period] It detects by the electrical-potential-difference detecting element in the impulse-wave output setting-out part 10a which is not illustrated. A pulse period is computed so that the average of pulse frequency may not be changed by the pulse period operation part in the impulse-wave output setting-out part 10a which is not illustrated from the outputs PF and VOUT of the pulse frequency setting-out part 11 which sets up pulse frequency, and VP and VB. In addition, VP and VB may be given as data and may calculate a pulse period, without using VP and VB. Moreover, it may not calculate but a pulse period may be set up as a data table. And the impulse-wave output setting-out part 10a outputs the impulse-wave output signal equivalent to a welding output combining the pulse frequency set up with the output of said error amplifier 8, and said pulse period. And the output of the peak current setting-out part which sets up peak current, or the output of the base current setting-out part which sets up base current is changed in a switching circuit part with the output of said impulse-wave output setting-out part.

[0019] The welding voltage ripple at the time of welding to drawing 7 with the consumable electrode type pulsed-arc-welding apparatus of the form of the 1st operation is shown. The welding voltage ripple of drawing 7 shows the welding voltage ripple at the time of reducing setting-out welding voltage from the conditions (conditions which a short circuit does not generate) of 1 impulse-wave 1 drops of drawing 11 . All assume welding load to be this condition, and show the condition that assume that welding load was changed and the pulse frequency of the welding voltage ripple falls in drawing 7 and 11.

[0020] When reducing setting-out welding voltage from the conditions of drawing 11 , pulse

frequency is understood that it does not change before changing setting-out welding voltage (drawing 11) by decreasing a pulse period. Since a pulse period is shortened from the optimal value for 1 impulse-wave 1 drops, it stops in this case, being 1 impulse-wave 1 drops. However, since a fixed quantity of droplets are made to form at the head of a wire for every impulse wave, a short circuit occurs for every termination of a pulse period, and a fixed quantity of droplets shift to a base material. That is, when reducing welding voltage, the droplet at the head of a wire does not carry out secession, but the magnitude of the droplet which remains at the head of a wire becomes uniform, and shifts to a base material regularly by the short circuit generated after the termination of a pulse period. Moreover, even if the amount of migration to the base material of the droplet for every impulse wave reduces welding voltage, since the average of pulse frequency does not change, it is the same as the case where they are the conditions (conditions that welding voltage is high) of 1 impulse-wave 1 drops. By these, birth of a spatter can be controlled and weld can be stabilized. As shown in drawing 4 , when setting up a pulse period Moreover, the amount of wire feeding, It prevents that prepare the limiter setting-out part which sets up the upper limit and lower limit of a pulse period according to at least one of a wire gage or the wire construction material in said impulse-wave output setting-out part 10a, and the pulse period which is not suitable for weld is set up, and weld is stabilized.

[0021] (Form 2 of operation) The consumable electrode type pulsed-arc-welding apparatus which enforced the impulse-wave power control approach of the 2nd invention is explained along with drawing 2 and drawing 8 . In addition, the same part as the form 1 of the conventional architecture and implementation attaches the same code, and omits the description.

[0022] [namely, the consumable electrode type pulsed-arc-welding apparatus of the form of the 2nd operation] The welding voltage detecting element 7 which detects welding voltage, and the welding voltage setting-out part 9 which sets up welding voltage, The error amplifier 8 which considers the output of said welding voltage detecting element 7, and the output of said welding voltage setting-out part 9 as an input, and amplifies the difference of these two inputs, The pulse period setting-out part 13 which sets up a pulse period, and the pulse frequency setting-out part 11 which sets up the pulse frequency for a peak current operation, To a peak current operation, [output / the average welding voltage VOUT of the output of said welding voltage detecting element 7, or the output of said welding voltage setting-out part 9 obtained using either at least, and / of said welding voltage detecting element 7 / the welding voltage VP in a peak term, and the welding voltage VB in a base period] It detects by the electrical-potential-difference detecting element in the peak current operation part 22 which is not illustrated. Peak current is calculated so that the average of pulse frequency may not be changed by the operation part in the peak current operation part 22 which is not illustrated

from the outputs PF and VOUT of the pulse frequency setting-out part 11 which sets up pulse frequency, and VP and VB. In addition, VP and VB may be given not as a detection value but as data, and do not need to use VP and VB about the operation of peak current. Moreover, it may not calculate but peak current may be set up as a data table. And the impulse-wave output signal which is equivalent to a welding output in the impulse-wave output setting-out part 10b which considers the output of said error amplifier 8 and the output of said pulse period setting-out part 13 as an input is outputted. And the output of said peak current operation part 22 which sets up peak current, or the output of the base current setting-out part 15 which sets up base current is changed in the switching circuit part 12 with the output of said impulse-wave output setting-out part 10b.

[0023] The welding voltage ripple at the time of welding to drawing 8 with the consumable electrode type pulsed-arc-welding apparatus of the form of the 2nd operation is shown. The welding voltage ripple of drawing 8 shows the welding voltage ripple at the time of reducing setting-out welding voltage from the conditions (conditions which a short circuit does not generate) of 1 impulse-wave 1 drops of drawing 11 . All assume welding load to be this condition, and show the condition that assume that welding load was changed and drawing 8 and the pulse frequency of the welding voltage ripple of 11 fall.

[0024] When reducing setting-out welding voltage from the conditions of drawing 11 , pulse frequency is understood that it does not change before changing setting-out welding voltage (drawing 11) by decreasing a pulse period. Since peak current falls from the optimal value for 1 impulse-wave 1 drops, it stops in this case, being 1 impulse-wave 1 drops. However, since a fixed quantity of droplets are made to form at the head of a wire for every impulse wave, a short circuit occurs for every termination of a pulse period, and a fixed quantity of droplets shift to a base material. That is, when reducing welding voltage, the droplet at the head of a wire does not carry out secession, but the magnitude of the droplet which remains at the head of a wire becomes uniform, and shifts to a base material regularly by the short circuit generated after the termination of a pulse period. Moreover, even if the amount of migration to the base material of the droplet for every impulse wave reduces welding voltage, since the average of pulse frequency does not change, it is the same as the case where they are the conditions (conditions that welding voltage is high) of 1 impulse-wave 1 drops. By these, birth of a spatter can be controlled and weld can be stabilized. Moreover, the pulse period setting-out part which sets up a pulse period as shown in drawing 5 can be set up according to at least one of the amount of wire feeding, a wire gage, or the wire construction material, and the response range expands it. Moreover, the pulse frequency setting-out part which sets up the pulse frequency of the 1st and the consumable electrode type pulsed-arc-welding apparatus of the 2nd invention as shown in drawing 5 can be set up according to at least one of the amount of wire feeding, a wire gage, or the wire construction material, and the response range expands it.

[0025] (Form 3 of operation) The consumable electrode type pulsed-arc-welding apparatus which enforced the impulse-wave power control approach of the 3rd invention is explained along with drawing 3 and drawing 9 . In addition, the same part as the forms 1 and 2 of the conventional architecture and implementation attaches the same code, and omits the description.

[0026] [namely, the consumable electrode type pulsed-arc-welding apparatus of the 3rd invention] The comparing element 16 which outputs a droplet secession forecast signal when the comparison operation of the welding voltage detecting element 7 which detects welding voltage, and the output of said welding voltage detecting element 7 and the output of the electrical-potential-difference setting-out part 17 is carried out and the output of said welding voltage detecting element 7 exceeds the output of said electrical-potential-difference setting-out part 17, and the welding voltage setting-out part 9 which sets up welding voltage, The error amplifier 8 which considers the output of said welding voltage detecting element 7, and the output of said welding voltage setting-out part 9 as an input, and amplifies the difference of these two inputs, The pulse frequency operation part 18 which considers the output of said error amplifier 8 as an input, and sets up pulse frequency, The impulse-wave output setting-out part 10c which considers the output of said comparing element 16, and the output of said pulse frequency operation part 18 as an input, makes the output of said pulse frequency operation part 18 a pulse period start signal, and sets up a pulse period using the output of said comparing element 16 as a termination signal of a pulse period, It has the peak current setting-out part 14 which sets up peak current, the base current setting-out part 15 which sets up base current, and the switching circuit part 12 which chooses the output of said peak current setting-out part 14, or the output of said base current setting-out part 15 with the output of said impulse-wave output setting-out part 10c.

[0027] Drawing 9 indicates the welding voltage ripple to be the droplet transfer at the time of welding with the consumable electrode type pulsed-arc-welding apparatus of the 3rd invention, and welding voltage is reduced from drawing 11 . If the droplet at the head of a wire shifts to a pulse period from a base period, as shown in (b) from (a), it will become large. Next, a droplet tends to break away according to the electromagnetism pinch force of peak current, and the vena contracta occurs (c). Since the constant current control during a pulse period, when the vena contracta occurs, a resistance component increases and welding voltage rises. Just before droplet secession is detected by comparing lifting of this welding voltage with a predetermined electrical potential difference. A pulse period is ended after that. That is, since a fixed quantity of droplets are made to form at the head of a wire and a pulse period is terminated, a short circuit is generated regularly and the (d) droplet is made to shift after the termination of a pulse period. Droplet transfer for every impulse wave is made regular by this, and the yield of a spatter can be controlled.

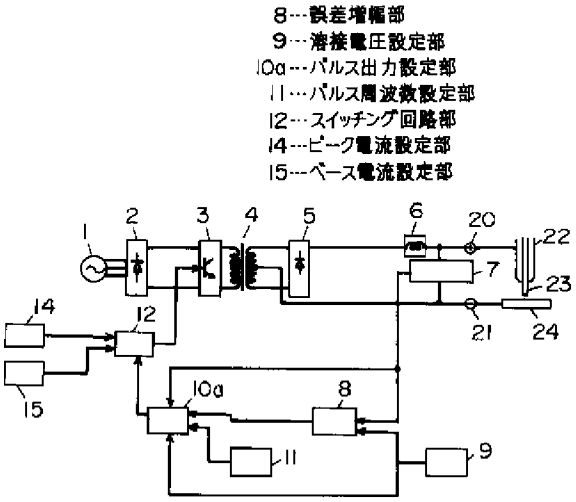
[0028] Moreover, as shown in drawing 6 , the base current setting-out part of said 1st the 2 and the consumable electrode type pulsed-arc-welding apparatus of the 3rd invention is set up according to at least one setting out of the amount of wire feeding, wire construction material, or a wire gage. For this reason, an optimum value can be set up for every amount of wire feeding, wire construction material, and wire gage, and the response range is expanded.
[0029] Moreover, as shown in drawing 6 , the peak current setting-out part of said 1st [the] and the consumable electrode type pulsed-arc-welding apparatus of the 3rd invention is set up according to at least one setting out of the amount of wire feeding, wire construction material, or a wire gage. For this reason, an optimum value can be set up for every amount of wire feeding, wire construction material, and wire gage, and the response range is expanded.
[0030]
[Effect of the Invention] [the impulse-wave power control approach of this invention, and a consumable electrode type pulsed-arc-welding machine] When reducing welding voltage, the effectiveness which controls birth of a spatter is done so by making uniform magnitude of the droplet for every impulse wave because a pulse period reduces abbreviation or peak current, and generating a short circuit regularly. Moreover, the effectiveness which controls birth of a spatter is done so by foreknowing secession of a droplet and ending a peak term by making uniform similarly magnitude of the droplet for every impulse wave, and generating a short circuit regularly.

[Brief Description of the Drawings]
[Drawing 1] The graphical diagram showing the form of the operation of a consumable electrode type arc-welding apparatus which enforced the 1st impulse-wave power control approach of this invention
[Drawing 2] The graphical diagram showing the form of the operation of a consumable electrode type arc-welding apparatus which enforced the 2nd impulse-wave power control approach of this invention
[Drawing 3] The graphical diagram showing the form of the operation of a consumable electrode type arc-welding apparatus which enforced the 3rd impulse-wave power control approach of this invention
[Drawing 4] The graphical diagram showing the form of operation of the pulse period setting-out part in the consumable electrode type arc-welding apparatus which enforced the impulse-wave power control approach of this invention
[Drawing 5] The graphical diagram showing the form of operation of the pulse period setting-out part and pulse frequency in the consumable electrode type arc-welding apparatus which

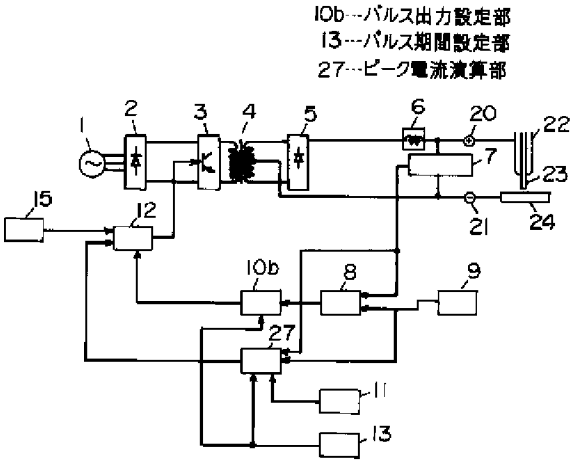
enforced the impulse-wave power control approach of this invention of a setting-out part
[Drawing 6] The graphical diagram showing the form of operation of the peak current setting-out part in the consumable electrode type arc-welding apparatus which enforced the impulse-wave power control approach of this invention, and a base current setting-out part
[Drawing 7] The welding voltage wave form chart at the time of reducing welding voltage and welding it using the consumable electrode type arc-welding apparatus which enforced the 1st impulse-wave power control approach of this invention
[Drawing 8] The welding voltage wave form chart at the time of reducing welding voltage and welding it using the consumable electrode type arc-welding apparatus which enforced the 2nd impulse-wave power control approach of this invention
[Drawing 9] The droplet transfer and the welding voltage wave form chart at the time of reducing welding voltage and welding it using the consumable electrode type arc-welding apparatus which enforced the 3rd impulse-wave power control approach of this invention
[Drawing 10] The graphical diagram showing the form of the operation of a consumable electrode type arc-welding apparatus which enforced the impulse-wave power control approach of conventional parallel
[Drawing 11] The welding voltage wave form chart at the time of welding on the optimal conditions for 1 impulse-wave 1 drops using the impulse-wave power control approach of conventional parallel
[Drawing 12] The droplet transfer and the welding voltage wave form chart at the time of reducing welding voltage and welding it using the impulse-wave power control approach of conventional parallel
[Explanations of letters or numerals]
7 Welding Voltage Detecting Element
8 Error Amplifier
9 Welding Voltage Setting-Out Part
10a, 10b, 10c Impulse-wave output setting-out part
11 Pulse Frequency Setting-Out Part
12 Switching Circuit Part
13 Pulse Period Setting-Out Part
14 Peak Current Setting-Out Part
15 Base Current Setting-Out Part
16 Comparing Element
17 Electrical-Potential-Difference Setting-Out Part
18 Pulse Frequency Operation Part
19 The Amount Setting-Out Part of Wire Feeding
25 Wire-Gage Setting-Out Part

26 Wire Construction Material Setting-Out Part
27 Peak Current Operation Part
28 Limiter Setting-Out Part

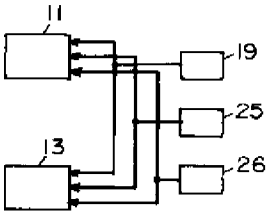
[Drawing 1]



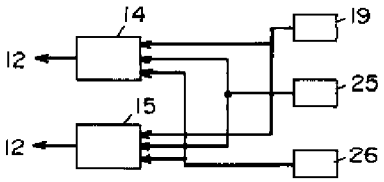
[Drawing 2]



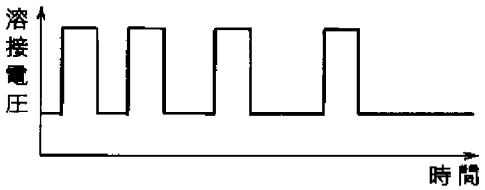
[Drawing 5]



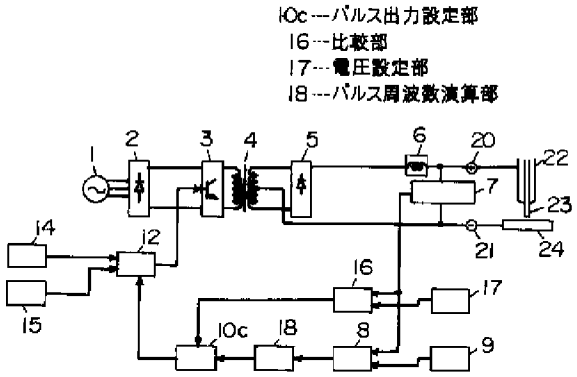
[Drawing 6]



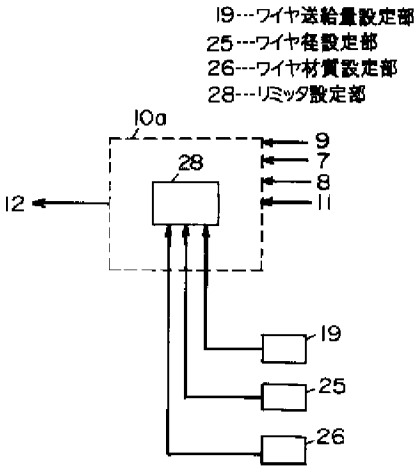
[Drawing 11]



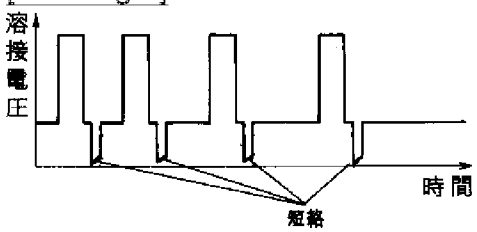
[Drawing 3]



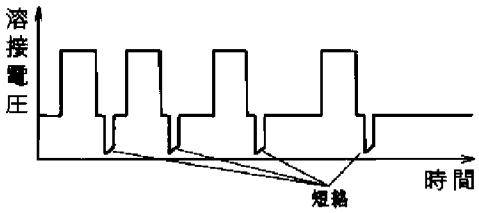
[Drawing 4]



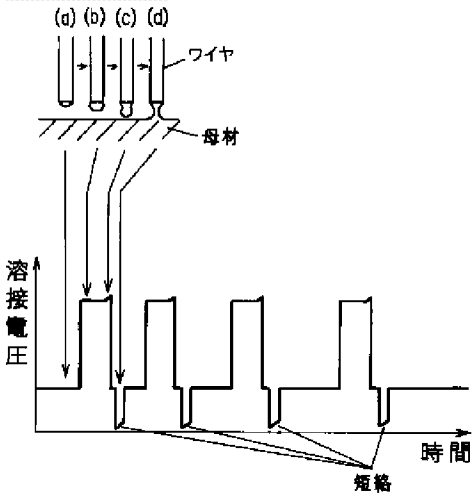
[Drawing 7]



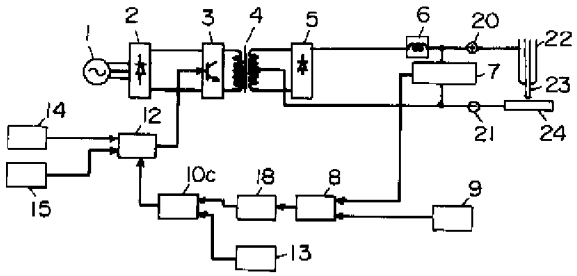
[Drawing 8]



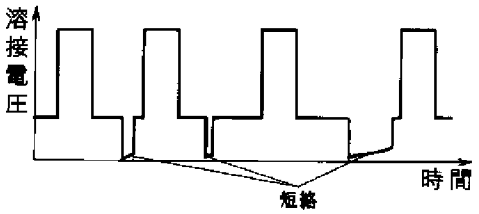
[Drawing 9]



[Drawing 10]



[Drawing 12]



[A Written Amendment]

[Filing Date] Heisei 11(1999) September 10 (1999. 9.10)
[Amendment 1]
[Document to be Amended] Description
[Item(s) to be Amended] Claims
[Method of Amendment] Alteration
[Proposed Amendment]
[Claim(s)]
[Claim 1] The impulse-wave power control approach which repeats peak current and base current to pulse form, supplies them between a welding wire and a weld base material, and is characterized by the thing of a welding output electrical potential difference or setting-out welding voltage for which a pulse period is set up to keep the average of the pulse frequency of a current constant using either at least.
[Claim 2] The impulse-wave power control approach according to claim 1 which repeats peak current and base current to pulse form, supplies them between a welding wire and a weld base material, and is characterized by the thing of a welding output electrical potential difference or setting-out welding voltage for which the pulse period of a current is set up using either and setting-out pulse frequency at least.
[Claim 3] The impulse-wave power control approach according to claim 1 or 2 characterized by setting up the upper limit and lower limit of a pulse period of a current according to at least one of the amount of wire feeding, a wire gage, or the wire construction material.
[Claim 4] The welding voltage detecting element which detects welding voltage, and the welding voltage setting-out part which sets up welding voltage, The error amplifier which considers the output of said welding voltage detecting element, and the output of said welding voltage setting-out part as an input, and amplifies the difference of these two inputs, The pulse frequency setting-out part which sets pulse frequency to a pulse period operation to keep the average of pulse frequency constant, The impulse-wave output setting-out part which outputs the impulse-wave output signal which is equivalent to a welding output from the output of said welding voltage detecting element, the output of said welding voltage setting-out part, the output of said pulse frequency setting-out part, and the output of said error amplifier, The consumable electrode type pulsed-arc-welding apparatus equipped with the peak current setting-out part which sets up peak current, the base current setting-out part which sets up base current, and the switching circuit part which chooses the output of said peak current setting-out part, or the output of said base current setting-out part with the output of said impulse-wave output setting-out part.
[Claim 5] The amount setting-out part of wire feeding which sets up the amount of wire feeding, and the wire-gage setting-out part which sets up a wire gage, The wire construction material setting-out part which sets up wire construction material, The output of said amount setting-out

part of wire feeding, the output of a wire-gage setting-out part, and the output of a wire construction material setting-out part are considered as an input. The consumable electrode type pulsed-arc-welding apparatus [equipped with said impulse-wave output setting-out part having contained the limiter setting-out part which sets up the upper limit and lower limit of a pulse period according to at least one of the amount of wire feeding, a wire gage, or the wire construction material] according to claim 4.

[Claim 6] The impulse-wave power control approach which repeats peak current and base current to pulse form, supplies them between a welding wire and a weld base material, and is characterized by the thing of a welding output electrical potential difference or setting-out welding voltage for which peak current is set up to keep the average of pulse frequency constant using either and setting-out pulse frequency at least.

[Claim 7] The welding voltage detecting element which detects welding voltage, and the welding voltage setting-out part which sets up welding voltage, The error amplifier which considers the output of said welding voltage detecting element, and the output of said welding voltage setting-out part as an input, and amplifies the difference of these two inputs, The pulse period setting-out part which sets up a pulse period, and the pulse frequency setting-out part which sets pulse frequency to a peak current operation to keep the average of pulse frequency constant, The impulse-wave output setting-out part which outputs the impulse-wave output signal which considers the output of said error amplifier, and the output of said pulse period setting-out part as an input, and is equivalent to a welding output, The peak current operation part which considers the output of said welding voltage setting-out part, the output of said welding voltage detecting element, the output of said pulse period setting-out part, and the output of said pulse frequency setting-out part as an input, and sets up peak current, The consumable electrode type pulsed-arc-welding apparatus equipped with the base current setting-out part which sets up base current, and the switching circuit part which chooses the output of said peak current operation part, or the output of said base current setting-out part with the output of said impulse-wave output setting-out part.

[Claim 8] The amount setting-out part of wire feeding which sets up the amount of wire feeding, and the wire-gage setting-out part which sets up a wire gage, The wire construction material setting-out part which sets up wire construction material, The consumable electrode type pulsed-arc-welding apparatus [equipped with the pulse period setting-out part which sets up a pulse period according to at least one of the amount of wire feeding, a wire gage, or the wire construction material by considering the output of said amount setting-out part of wire feeding, the output of a wire-gage setting-out part, and the output of a wire construction material setting-out part as an input] according to claim 7.

[Claim 9] The amount setting-out part of wire feeding which sets up the amount of wire feeding, and the wire-gage setting-out part which sets up a wire gage, The wire construction material

setting-out part which sets up wire construction material, The output of said amount setting-out part of wire feeding, the output of said wire-gage setting-out part, and the output of said wire construction material setting-out part are considered as an input. The consumable electrode type pulsed-arc-welding apparatus [equipped with the pulse frequency setting-out part which sets up the pulse frequency for a pulse period operation according to at least one of the amount of wire feeding, a wire gage, or the wire construction material] according to claim 4 or 7.

[Claim 10] Between a welding wire and a weld base material, repeat peak current and base current to pulse form, supply them, and the droplet secession forecast signal which foreknows that a droplet secedes from a wire head using a welding output electrical potential difference is detected. The impulse-wave power control approach characterized by using this droplet secession forecast signal as timing of termination of the pulse period of a current, and setting up the pulse period of a current making it shift to a short condition.

[Claim 11] The comparing element which outputs a droplet secession forecast signal when the comparison operation of the welding voltage detecting element which detects welding voltage, and the output of said welding voltage detecting element and the output of an electrical-potential-difference setting-out part is carried out and the output of said welding voltage detecting element exceeds the output of said electrical-potential-difference setting-out part, The error amplifier which considers the welding voltage setting-out part which sets up welding voltage, and the output of said welding voltage detecting element and the output of said welding voltage setting-out part as an input, and amplifies the difference of these two inputs, The pulse frequency operation part which considers the output of said error amplifier as an input, and sets up pulse frequency, So that the output of said comparing element and the output of said pulse frequency operation part may be considered as an input, the output of said pulse frequency operation part may be made into a peak term start signal and it may be made to shift to a short condition, using the output of said comparing element as a termination signal of a peak term The impulse-wave output setting-out part which outputs the impulse-wave output signal equivalent to a welding output, The consumable electrode type pulsed-arc-welding apparatus equipped with the peak current setting-out part which sets up peak current, the base current setting-out part which sets up base current, and the switching circuit part which chooses the output of said peak current setting-out part, or the output of said base current setting-out part with the output of said pulse period setting-out part.

[Claim 12] The amount setting-out part of wire feeding which sets up the amount of wire feeding, and the wire-gage setting-out part which sets up a wire gage, The wire construction material setting-out part which sets up wire construction material, The output of said amount setting-out part of wire feeding, the output of a wire-gage setting-out part, and the output of a wire construction material setting-out part are considered as an input. A consumable electrode

type pulsed-arc-welding apparatus given in either of the Claims 4, 7 and 11 equipped with the base current setting-out part which sets up base current according to at least one of the amount of wire feeding, a wire gage, or the wire construction material.
[Claim 13] The amount setting-out part of wire feeding which sets up the amount of wire feeding, and the wire-gage setting-out part which sets up a wire gage, The wire construction material setting-out part which sets up wire construction material, The output of said amount setting-out part of wire feeding, the output of a wire-gage setting-out part, and the output of a wire construction material setting-out part are considered as an input. The consumable electrode type pulsed-arc-welding apparatus [equipped with the peak current setting-out part which sets up peak current according to at least one of the amount of wire feeding, a wire gage, or the wire construction material] according to claim 4 or 11.
[Amendment 2]
[Document to be Amended] Description
[Item(s) to be Amended] 0008
[Method of Amendment] Alteration
[Proposed Amendment]
[0008]
[Means for solving problem] In order to attain the above-mentioned technical problem, the impulse-wave power control approach of the 1st invention is a thing of a welding output electrical potential difference or setting-out welding voltage which sets up a pulse period to keep the average of pulse frequency constant using either at least. Moreover, when setting up a pulse period, it is the thing of a welding output electrical potential difference or setting-out welding voltage which sets up a pulse period to keep the average of pulse frequency constant using either and setting-out pulse frequency at least. Moreover, according to at least one of the amount of wire feeding, a wire gage, or the wire construction material, the upper limit and lower limit of a pulse period are set up this pulse period. Next, the consumable electrode type pulsed-arc-welding apparatus using the impulse-wave power control approach of the 1st invention is explained. The welding voltage detecting element which detects welding voltage, and the welding voltage setting-out part which sets up welding voltage, The error amplifier which considers the output of said welding voltage detecting element, and the output of said welding voltage setting-out part as an input, and amplifies the difference of these two inputs, The pulse frequency setting-out part which sets pulse frequency to a pulse period operation to keep the average of pulse frequency constant, The impulse-wave output setting-out part which outputs the impulse-wave output signal of the output of said welding voltage detecting element, and the output of said welding voltage setting-out part which is equivalent to a welding output using either, the output of said pulse frequency setting-out part, and the output of said error amplifier at least, It has the peak current setting-out part which sets up peak current, the base

current setting-out part which sets up base current, and the switching circuit part which chooses the output of said peak current setting-out part, or the output of said base current setting-out part with the output of said impulse-wave output setting-out part.

[Amendment 3]

[Document to be Amended] Description

[Item(s) to be Amended] 0009

[Method of Amendment] Alteration

[Proposed Amendment]

[0009] The impulse-wave power control approach of the 2nd invention is a thing of a welding output electrical potential difference or setting-out welding voltage which sets up peak current to keep the average of pulse frequency constant using either and setting-out pulse frequency at least. [the consumable electrode type pulsed-arc-welding apparatus of the 2nd invention] The welding voltage detecting element which detects welding voltage, and the welding voltage setting-out part which sets up welding voltage, The error amplifier which considers the output of said welding voltage detecting element, and the output of said welding voltage setting-out part as an input, and amplifies the difference of these two inputs, The pulse frequency setting-out part which sets pulse frequency to a peak current operation to keep the average of pulse frequency constant, The pulse period setting-out part which sets up a pulse period, and the peak current operation part of the output of said welding voltage setting-out part, or the output of said welding voltage detecting element which considers one of outputs, the output of said pulse period setting-out part, and the output of said pulse frequency setting-out part as an input at least, and sets up peak current, It has the base current setting-out part which sets up base current, and the switching circuit part which chooses the output of said peak current operation part, or the output of said base current setting-out part with the output of said impulse-wave output setting-out part.

[Amendment 4]

[Document to be Amended] Description

[Item(s) to be Amended] 0010

[Method of Amendment] Alteration

[Proposed Amendment]

[0010] The impulse-wave power control approach of the 3rd invention detects the droplet secession forecast signal which foreknows that a droplet secedes from a wire head using a welding output electrical potential difference, and this droplet secession forecast signal is used for it as timing of termination of a pulse period, and it sets up a pulse period to make it shift to a short condition. [the consumable electrode type pulsed-arc-welding apparatus of the 3rd invention] The comparing element which outputs a droplet secession forecast signal when the comparison operation of the welding voltage detecting element which detects welding voltage,

and the output of said welding voltage detecting element and the output of an electrical-potential-difference setting-out part is carried out and the output of said welding voltage detecting element exceeds the output of said electrical-potential-difference setting-out part, The error amplifier which considers the welding voltage setting-out part which sets up welding voltage, and the output of said welding voltage detecting element and the output of said welding voltage setting-out part as an input, and amplifies the difference of these two inputs, The pulse frequency operation part which considers the output of said error amplifier as an input, and sets up pulse frequency, So that the output of said comparing element and the output of said pulse frequency operation part may be considered as an input, the output of said pulse frequency operation part may be made into a peak term start signal and it may be made to shift to a short condition, using the output of said comparing element as a termination signal of a peak term The impulse-wave output setting-out part which outputs the impulse-wave output signal equivalent to a welding output, It has the peak current setting-out part which sets up peak current, the base current setting-out part which sets up base current, and the switching circuit part which chooses the output of said peak current setting-out part, or the output of said base current setting-out part with the output of said pulse period setting-out part.

[Translation done.]